

the present the claims in more definite form. The Examiner has questioned the meaning of “the orientation of the axis of rotation” in claims 1 and 12-16. The axis of rotation of the flywheel is determined by the axis of the bearing system in which the flywheel is mounted. The tilt sensors measure the angle of the bearing axis, but that is also the axis of rotation of the flywheel. Tilt sensors are mounted on the housing and the bearings are also mounted on the housing, so the tilt sensors measure the angle of the bearings and indirectly measure the angle of the axis of rotation of the flywheel. This confirms the Examiner’s interpretation. Applicant is willing to insert some additional text into claim 1 if the Examiner considers this explanation for the record to be insufficient.

Claims 1-8 and 13-16 have been rejected under 35 USC 103 as unpatentable over Blake in view of Bichler. Claim 1 calls for a flywheel energy storage system having an energy storage flywheel supported on a bearings and a motor and generator for accelerating and decelerating the flywheel for storing and retrieving energy. A tilt switch detects a non-vertical orientation of the axis of rotation, beyond a predetermined tolerance from vertical, and produces a signal to trigger appropriate corrective action.

Bichler teaches tilt sensors N1 that detect tilting of the flywheel rim with respect to the bearing system axis and to provide feedback control for the magnetic bearings. Contrary to the Examiner’s description, Bichler’s tilt sensors do not detect the tilt angle between the flywheel axis of rotation and the direction of gravity, but only the tilt angle between the bearing axis and the rotor axis. They are used as a component of the magnetic bearing to make corrections in the bearing operation. The claimed invention, on the other hand, uses a tilt sensor to detect the tilt angle between the axis of the bearing system and the direction of gravity.

The Examiner asserts that it would have been obvious to a person of ordinary skill in the art to modify Blake’s flywheel to incorporate a tilt sensor as taught by Bichler. Applicant does not believe that such a modification of Blake would be obvious because Blake’s bearing system is not capable of utilizing the signals that would be produced by Bichler’s tilt sensors. It would not be obvious to put sensors in Blake that have no useful function.

Even if Blake's bearing system were modified in some unspecified way to be able to utilize the signals from Bichler's tilt sensors, the resulting apparatus would still not fall within the scope of claim 1. Claim 1 calls for a tilt sensor that detects if the orientation of the axis of rotation is outside a predetermined tolerance from vertical. The Blake flywheel Battery system with Bichler's tilt sensor installed would not detect if the axis of rotation were outside a predetermined tolerance from vertical. It would only detect if the axis of rotation were different from the axis of the bearing system. If the modified flywheel battery system of Blake were tilted off of vertical, as long as the bearing axis and the rotor axis were aligned, there would be tilt signal from the tilt sensor of Bichler. Hence, Applicant believes that the combination of Blake and Bichler would not have made the subject matter of claims 1-8 and 13-16 obvious to a person of ordinary skill in the art.

Claims 9-12 have been rejected under 35 USC 103 as unpatentable over the combination of Blake, Bichler and Graebner. Graebner teaches an apparatus for making geophysical measurements, determining the angle of the gravitational field, and the deflection of the direction of gravity from the vertical. It is useful for locating subsurface features in well logging. It uses a gyroscope to determine the angle of gravity very precisely. Graebner has nothing to do with flywheel energy storage systems and Applicant considers Graebner to be non-analogous art. Those persons of ordinary skill in the flywheel energy storage system art would not be expected to consult the art of geodesy for any technology that would be useful in a flywheel system.

Even if a person of ordinary skill in the flywheel art were, unaccountably, to consult the field of geodesy and discover the Graebner reference, there is nothing in Graebner or any other cited reference that would inspire him to attempt to incorporate anything in Graebner into a flywheel energy storage system. Why would he care if there is a deflection of the gravity field from the vertical? Such deflections are so minute that they are of absolutely no consequence to flywheel energy storage and retrieval systems.

Assuming, against all reason and common sense, that a person of ordinary skill in the art were determined to incorporate Graebner into the combination of Blake and Bichler as proposed by the Examiner. What would that combination look like?

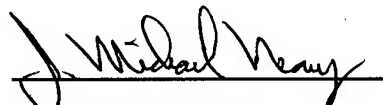
Applicant does not have the slightest idea what it would look like. The Examiner's explanation is not much help. The Examiner refers to a "mechanical switch 42" in Graebner's Fig. 3, but there is no mechanical switch in Graebner's Fig. 3. His item 42 is a pendulum.

Thus Applicant does not believe that Graebner teaches any applicable technology of use to a flywheel energy storage system, and the technology he does teach, the measurement of the deflection of the gravity field from vertical, is of no use to flywheel energy storage systems. Accordingly, Applicant believes that claims 9-12 are patentable over the combination of Blake, Bichler and Graebner proposed by the Examiner.

Claim 17 has been rejected under 35 USC 103 as unpatentable over Blake in view of Hockney. Hockney discloses a flywheel energy storage system that uses a gimbal mount to maintain vertical orientation of the spinning shaft despite variations in local ground inclination due to such affects as frost heaves and earthquake. Hockney does not disclose use of a tilt sensor. With use of the gimbal to maintain vertical alignment, no tilt sensor would be needed since the axis of the flywheel can not deviate from vertical. Use of gimbaling adds significant costs and size, which are sought to be eliminated by the inclusion of the tilt switch with the invention. Hence, the combination of Blake and Hockney would not result in an apparatus within the scope of claim 17, so claim 17 should be patentable over this combination.

Applicant believes his claims as amended herein are patentable over the references cited by the Examiner. If the Examiner, after his reconsideration of this application and the amended claims herein, concurs that they are indeed patentable, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "J. Michael Neary", written over a horizontal line.

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Appendix Showing Changes to the Specification

Other types of active magnetic thrust bearings could also be used. For example, a bearing like that disclosed in my U.S. Patent Application No. [XXXXXX] 10/053,150 entitled “Active Magnetic Thrust Bearing” filed on November 2, 2001, the disclosure of which is incorporated herein by reference, could be used.

Appendix Showing Changes to Claims

7. (Amended) A flywheel energy storage system as described in claim 1 wherein:
said tilt [switch] sensor detects excessive tilting of said flywheel energy storage system when the axis of rotation of said flywheel is more than 10 degrees from vertical.
8. (Amended) A flywheel energy storage system as described in claim 1 wherein:
said tilt [switch] sensor detects excessive tilting of said flywheel energy storage system when the axis of rotation of said flywheel is more than 5 degree from vertical.
11. (Amended) A flywheel energy storage system as described in claim 10 wherein:
said tilt sensor includes a pendulum hanging inside an opening in an annular electrical contact;
whereby said pendulum contacts said annular electrical contact and completes an electrical circuit to generate said signal when said flywheel energy storage system tilts beyond said predetermined tolerance from vertical..
12. (Amended) A flywheel energy storage system as described in claim 1 wherein:
said tilt [switch] sensor detects [if] whether the orientation of the axis of rotation is inside or outside of tolerance from vertical by detecting [if] the tilt angle of the axis of rotation [is acceptable or not].
15. (Amended) A flywheel energy storage system as described in claim 1 wherein:
detection of the orientation of the axis of rotation being too far from vertical causes prevention of power application to said motor [means].



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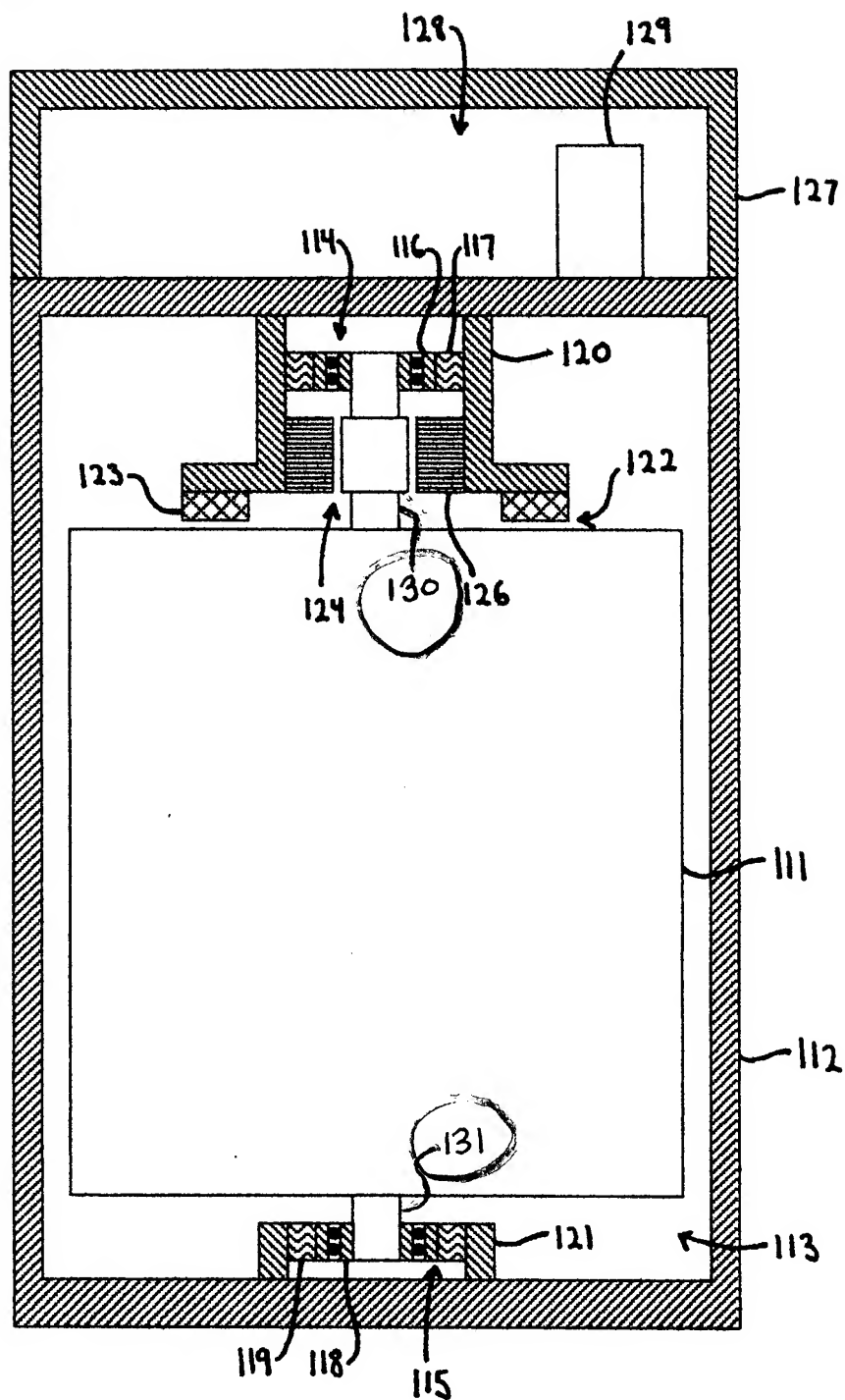


Figure 3